Lyme Disease

(Also known as Lyme borreliosis and Tickborne meningopolyneuritis)

---

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Lyme disease (LD) is caused by the corkscrew-shaped bacterium (spirochete) *Borrelia burgdorferi*.

B. Clinical Description

While the chronology of signs and symptoms can vary significantly, there are three general stages in the clinical manifestation of LD: early localized, early disseminated, and late.

Early Localized

Signs and symptoms during the early illness tend to be nonspecific and include fever, muscle aches, headache, mild neck stiffness, and joint pain. Erythema migrans (EM) occurs at the site of the tick bite in approximately 90% of cases, although when these painless lesions occur in a location hidden from view (armpit, back, etc.), they are often not seen by the patient. Typically, EM rashes are circular and grow to a diameter of 5 to 15 cm, although the shape can be triangular, oval, or irregular. EM frequently clears in the center, resulting in the classic "bull's-eye" presentation, but this does not always occur. The rash may be reported as warm or itchy, but it is usually painless.

Early Disseminated

In untreated persons, multiple EM rashes may appear within 3 to 5 weeks after the tick bite. These secondary lesions, indicative that the infection has spread into the blood, resemble the primary lesion but tend to be smaller. Common signs of early disseminated disease also include mild eye infections and the paralysis of facial muscles (Bell's palsy). More systemic signs of this stage are headache, fatigue, and muscle and joint pain. At this stage, disruptions of heart rhythm occur in less than 10% of cases.

Late

Most commonly, late disease is marked by recurrent arthritis (swelling and pain) in the knees and shoulders. Other joints may also be involved. Neurological signs may involve impairment of mood, sleep, or memory; paralysis of facial muscles; pain or tingling sensations in the extremities; and less commonly, meningitis and encephalitis. Late-stage symptoms can persist for several years, but tend to resolve spontaneously.

Generally, prophylactic antibiotic therapy is not indicated after a tick bite, as the risk of infection with *B. burgdorferi* after a tick bite is relatively low, even in endemic areas.

C. Vectors and Reservoirs:

The primary vectors for LD are *Ixodes* ticks, a distinct genus from the larger and better-known dog tick (*Dermacentor variabilis*). In Massachusetts, the prominent vector is *I. scapularis*, or the deer tick. Ticks acquire the spirochete that causes LD during their young, larval stage by feeding on infected animals, especially the white-footed mouse. The tick poses the greatest threat of transmitting infectious organisms to animals and humans when it bites during its next (nymphal) stage of life. Nymphs are most abundant between May and July, and they are typically found in grasses and brush. Towards the end of summer through fall, the ticks mature to the adult stage. Although adult ticks remain capable of transmitting *B. burgdorferi* to humans, they are less likely to do so.

D. Modes of Transmission:

LD is acquired from a tick bite. Laboratory data suggest that the tick must usually remain attached for 24 to 48 hours before the transmission of *B. burgdorferi* can occur. Since bites from *I. scapularis* are often painless and may occur on parts of the body that are difficult to observe, cases of diagnosed LD frequently have no known history of a tick bite.

E. Incubation Period

EM typically develops between 7 and 10 days after exposure (range 3 to 32 days). However, an infected individual can remain asymptomatic until the later stages of LD, several months to one year later.

F. Period of Communicability or Infectious Period

Lyme disease is not communicable from person-to-person.

G. Epidemiology

The incidence of LD is associated with the density of infected tick vectors. While most cases in the United States have been reported in the Northeast, western states, and upper Midwest, nearly all states have reported cases. LD incidence varies greatly among states, among counties, and by season. Most cases occur between April and October, when the risk of contact with nymphal ticks is greatest.

In Massachusetts, the areas of highest risk for acquiring LD include Cape Cod and southeastern Massachusetts, Nantucket and Martha's Vineyard, areas north of Boston, along the Quabbin Reservoir Watershed and Connecticut River Valley in western Massachusetts. However, all parts of the state are considered to have LD, and human cases have been reported from all counties in Massachusetts in individuals without a travel history to high-risk areas.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. What to Report to the Massachusetts Department of Public Health

- Any case of Lyme disease diagnosed by a healthcare provider based on clinical signs and symptoms, regardless of whether or not laboratory confirmation testing was done.

Note: See Section 3) C below for information on how to report a case.

B. Laboratory Testing Services Available

Laboratory confirmation of infection with *B. burgdorferi* is established when a laboratory isolates the spirochete from tissue or body fluid, detects diagnostic levels of IgM or IgG antibodies to the spirochete in serum or cerebrospinal fluid, or detects a significant change in antibody levels in paired acute and convalescent serum samples. Since the immune response to spirochetes is relatively slow, serological tests often remain negative for several weeks after exposure. The Centers for Disease Control and Prevention (CDC) recommends that, initially, serum specimens be tested by a sensitive test such as an enzyme immunoassay (EIA) or immunofluorescent assay (IFA). Samples with positive or equivocal results from these tests should be re-tested using a standardized Western blot procedure.

The Massachusetts State Laboratory Institute (SLI), Viral Serology Laboratory will perform Lyme disease confirmatory testing by Western blot assay on specimens that are either positive or equivocal by a Lyme-specific test, such as EIA or IFA. For more information about submitting sera for testing, call the Viral Serology Laboratory at (617) 983-6396.

Note: The SLI does not provide services for tick identification or testing of ticks for *B. burgdorferi*.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify where Lyme disease occurs in Massachusetts.
- To recognize areas in Massachusetts where Lyme disease incidence has changed (increased or decreased).
- To focus preventive education.
- To target tick control measures.

B. Laboratory and Healthcare Provider Reporting Requirements

Refer to the lists of reportable diseases (at the end of this manual's Introduction) for information.

Note: MDPH is actively working to improve reporting of LD cases. As part of this effort, some healthcare providers will fax or mail a MDPH *Lyme Disease Reporting Form* directly to the MDPH Division of Epidemiology and Immunization, Surveillance Program. When this occurs, the Surveillance Program will send information on any confirmed cases of Lyme disease to the LBOH where the case resides. No further follow-up by the local board of health will then be necessary.

C. Local Board of Health Reporting and Follow-up Responsibilities

1. **Reporting Requirements**

Massachusetts Department of Public Health (MDPH) regulations (*105 CMR 300.000*) stipulate that each local board of health (LBOH) must report the occurrence of any case of Lyme disease, as defined by the reporting criteria in Section 2) A above. Current requirements are that cases be reported to the MDPH Division of Epidemiology and Immunization, Surveillance Program using an official MDPH *Lyme Disease Reporting Form* (in Appendix A). Refer to the *Local Board of Health Reporting Timeline* (at the end of this manual's introductory section) for information on prioritization and timeliness requirements of reporting and case investigation.

2. **Case Investigation**

a. It is the LBOH responsibility to complete the MDPH *Lyme Disease Reporting Form* (in Appendix A) by interviewing the case and others who may be able to provide pertinent information. Much of the information required on the form can be obtained from the case's healthcare provider or the medical record.

b. There are two Lyme disease (LD) case report forms: multiple and single. The multiple-case *Lyme Disease Reporting Form* allows you to report up to five cases per form. The single-case LD report form only has space for one case per form. Either form may be used for reporting.

c. Use the following guidelines to assist in completing the form:
   1) Accurately record the demographic information, date of symptom onset, and date of diagnosis.
   2) Record information about clinical presentation by checking all of the signs and symptoms that apply. There is space to note any other symptoms not already listed on the form. (*Note:* questions about clinical signs and symptoms that do not meet the CDC case criteria are asked to help MDPH gain a better understanding for the spectrum of signs and symptoms experienced by LD patients.)
   3) Record the name of the laboratory performing LD testing, if done.
   4) If the case was diagnosed at the same time as another tick-borne disease (such as ehrlichiosis, babesiosis, or Rocky Mountain spotted fever) please refer to other chapters in this manual and complete the appropriate case report form.
   5) If you have made several attempts to obtain case information, but have been unsuccessful (*e.g.*, the case or healthcare provider does not return your calls or respond to a letter, or the case refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as you have gathered. Please note on the form the reason why it could not be filled out completely.

d. After completing the form, attach lab report(s) and mail (in an envelope marked "Confidential") to the MDPH Division of Epidemiology and Immunization, Surveillance Program. The mailing address is:
MDPH, Division of Epidemiology and Immunization
Surveillance Program, Room 241
305 South Street
Jamaica Plain, MA 02130

e. Institution of disease control measures is an integral part of case investigation. It is the LBOH responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4), Controlling Further Spread.

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (*105 CMR 300.200*)

None.

B. Protection of Contacts of a Case

None.

C. Managing Special Situations

Response to a Tick Bite

Generally, prophylactic antibiotic therapy is not indicated because the risk of infection with *B. burgdorferi* after a tick bite is relatively low, even in endemic areas. Prophylactic therapy may be appropriate for some individuals (*e.g.*, pregnant women) while more data are collected.

D. Preventive Measures

Offer the following advice to the public to reduce risk for LD.

Environmental Measures

Prevention of Lyme disease involves keeping wildlife (especially deer and rodents) out of your backyard and making your yard less attractive to ticks.

- Remove leaf litter and brush from around your home.
- Prune low-lying bushes to let in more sunlight.
- Mow lawns regularly.
- Make sure any plants near your home are not varieties that attract deer.
- Keep woodpiles in sunny areas off the ground.
- Clean up the ground around bird feeders.
- If you are going to use insecticides around your home, always follow the label instructions and never use near streams or other bodies of water.

Personal Preventive Measures/Education

The best preventive measure is to avoid tick-infested areas. In areas where contact with ticks may occur, individuals should be advised of the following:

- Wear long-sleeved shirts and long, light-colored pants tucked into socks or boots.
- Stay on trails when walking or hiking and avoid high grass.
- Use insect repellants properly. Repellants that contain DEET (diethyltoluamide) should be used in concentrations no higher than 15% for children and 30% for adults. Remember, repellants should *never* be used on infants. Permethrin is a repellant that can only be applied to clothing, *not* exposed skin.
- After each day spent in tick-infested areas, check yourself, your children, and your pets for ticks. Parts of the body ticks like most include the back of the knee, armpit, scalp, groin, and back of the neck.

- Promptly remove any attached tick using fine-point tweezers. The tick should not be squeezed or twisted, but grasped close to the skin and pulled straight out with steady pressure. Once removed, the tick should be drowned in rubbing alcohol or the toilet.
- Consider vaccination if residing in an endemic area and your occupational or recreational activities put you into regular contact with tick-infested environments.

Note: Since December, 1998 a vaccine has been available for LD (LYMErix, Glaxo SmithKline). In clinical trials, the vaccine was demonstrated to be about 70 to 80% effective in protecting individuals aged 15–70 years who received three doses of the vaccine according to the approved administration schedule. Since the vaccine is not 100% effective and does not protect against other tick-borne diseases, immunized individuals should continue to practice the preventive measures described above. Accelerated 3 and 6 month vaccination schedules and the efficacy of this vaccine in children under 15 are also being evaluated.

A *Lyme Disease Public Health Fact Sheet* can be obtained from the Division of Epidemiology and Immunization or through the MDPH web site at <http://www.state.ma.us/dph/>. Click on the "Publications" link and scroll down to the Fact Sheets section.

ADDITIONAL INFORMATION

The following is the formal CDC and Council of State and Territorial Epidemiologists (CSTE) surveillance case definition for Lyme disease. It is provided for your information only and should not affect the investigation or reporting of a case that fulfills the criteria in Section 2) A of this chapter. (CDC case definitions are used by state health departments and the CDC to maintain uniform standards for national reporting.) For reporting to the MDPH, always use the criteria outlined in Section 2) A.

Case classification: (for surveillance purposes only)
a) a person with a physician-diagnosed erythema migrans => 5cm, or
b) a person with at least one late manifestation *and* laboratory confirmation of infection

Definitions of terms used in the case classification:

Erythema migrans (EM): For purposes of surveillance, EM is a skin lesion that typically begins as a red macule or papule and expands over a period of days to weeks to form a large round lesion, often with partial central clearing. A solitary lesion must reach at least 5 cm in size. Secondary lesions may also occur. EM does not always present as a classic "bull's eye." It may present as an irregular erythematous patch (with or without central clearing), as an oval or triangular erythematous lesion, as an elongated erythematous lesion, or as multiple erythematous lesions. Annular erythematous lesions occurring within several hours of a tick bite represent hypersensitivity reactions and do not qualify as EM. In most patients, the expanding EM lesion is accompanied by other acute symptoms, particularly fatigue, fever, headache, mild stiff neck, arthralgias, or myalgias. These symptoms are typically intermittent. A physician must make the diagnosis of EM. Laboratory confirmation is recommended for persons with no known exposure.

Late manifestations: These include any of the following when an alternate explanation is not found:
a) Musculoskeletal system –Recurrent, brief attacks (weeks or months) of objective joint swelling in one or a few joints sometimes followed by chronic arthritis in one or a few joints. Manifestations *not* considered as criteria for diagnosis include chronic progressive arthritis not preceded by brief attacks and chronic symmetrical polyarthritis. Additionally, arthralgias, myalgias, or fibromyalgia syndromes alone are *not currently* accepted as CDC/CSTE criteria for musculoskeletal involvement.
b) Nervous system – Lymphocytic meningitis, cranial neuritis, particularly facial palsy (may be bilateral), radiculoneuropathy or, rarely, encephalomyelitis alone or in combination. Encephalomyelitis must be

confirmed by showing antibody production against *B. burgdorferi* in the cerebrospinal fluid (CSF), demonstrated by a higher titer of antibody in CSF than in serum. Headache, fatigue, paresthesias, or mild stiff neck alone are *not currently* accepted as CDC/CSTE criteria for neurologic involvement.

c) Cardiovascular system – Acute onset, high-grade (2^{nd}-degree or 3^{rd}-degree) atrioventricular conduction defects that resolve in days to weeks and are sometimes associated with myocarditis. Palpitations, bradycardia, bundle branch block, or myocarditis alone are *not currently* accepted as CDC/CSTE criteria for cardiovascular involvement.

Laboratory confirmation: Laboratory confirmation of infection with *B. burgdorferi* is established when a laboratory isolates the spirochete from tissue or body fluid, detects diagnostic levels of IgM or IgG antibodies to the spirochete in serum or CSF, or detects a significant change in antibody levels in paired acute and convalescent serum samples.

REFERENCES

American Academy of Pediatrics. *1997 Red Book: Report of the Committee on Infectious Diseases, 24th Edition*. Illinois, American Academy of Pediatrics, 1997.

American Lyme Disease Foundation, Inc. *A Quick Guide to Lyme Disease: How to Protect Yourself and Your Family from Serious Infection.* (Not dated.)

CDC. Case Definitions for Infectious Conditions under Public Health Surveillance. *MMWR.* 1997; 46:RR-10.

Chin, J., ed. *Control of Communicable Diseases Manual, 17th Edition.* Washington, DC, American Public Health Association, 2000.

Gardner, P. Lyme Disease Vaccines. *Ann Intern Med*. 1998; 129: 583-5.

MDPH. *Regulation 105 CMR 300.000: Reportable Diseases and Isolation and Quarantine Requirements*. MDPH, Promulgated November 1998, (Printed July 1999).

Oregon Health Division. *Investigative Guidelines: Lyme Disease*. Oregon Health Division, May, 1996.